

Customer No.: 31561
Docket No.: 13869-US-PA
Application No.: 10/711,838

REMARKS

Present Status of the Application

The Final Office Action rejected all presently-pending claims 1-15. Specifically, the Office Action rejected claims 1-2, 4-6 under 35 U.S.C. 103(a), as being unpatentable by Chen et al. (U.S. 6,692,903). The Office Action also rejected claims 8-10, 12-14 under 35 U.S.C. 103(a) as being unpatentable over Chen in view of Mui (U.S. 2003/0228532). The Office Action rejected claims 3 and 11 under 35 U.S.C. 103(a) as being unpatentable over Chen in view of Wolf et al. (Silicon Processing for the VLSI Era, Vol. 1, Lattice Press (1986)). The Office Action rejected claims 7 and 15 under 35 U.S.C. 103(a) as being unpatentable over Chen in view of Wolf et al. (Silicon Processing for the VLSI Era, Vol. 4, Lattice Press (2002)).

Applicant has reply on 2006/2/23. Then, the advisory action mailed on 2006/3/17 stated applicant has not provided any evidence to support the argument of that the transposition of two process steps in claims 1 and 9 is not identical or equivalent in terms of function, manner and result.

Now, applicant provides a photograph to support this position, and reconsideration of those claims is respectfully requested.

Discussion of Office Action Rejections

The Office Action rejected claims 1-2, 4-6 under 103(a) as being unpatentable over Chen et al. (U.S. 6,692,903). Applicant respectfully traverses the rejections for at least the reasons set forth below.

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The Office Action pointed out Chen does not expressly disclose that the cleaning step is performed before the step of etching the material layer. Case law has held that transposition of process steps, where the processes are substantially identical or equivalent in terms of function, manner and result, does not patentably distinguish the processes. However, Applicant submits the transposition of the process steps of claim 1 of the present invention is not identical or equivalent in terms of function, manner and result to Chen's reference.

In claim 1 of the present invention, the cleaning step is performed before the material layer is etched. In other words, the cleaning step is performed before the material layer is etched such that the polymer generated in the etching step of the BARC can be removed before etching the material layer. *Because the polymer remained on the patterned photoresist layer can be removed before etching the material layer, the patterns of the photoresist layer can be accurately transferred to the material layer in the etching process of the material layer.* If the cleaning step is not performed before etching the material layer, the polymer generated from the etching step of the BARC will still remain on the patterned photoresist layer, and then the pattern of the remained polymer may also be transferred to the material layer when etching the material layer subsequently, as a result the patterned material layer does not have accurate feature patterns.

However, Chen teaches the anti-reflective material 50 is etched, and the electrically conductive material 45 may then be etched. Thereafter, the diffusion barrier layer 40 may be etched. After completion of the etching processes, the substrate 30 is transported out of the etching chamber and into the transfer chamber 125. Then, the substrate 30 may be transferred from the transfer chamber 125 into a cleaning chamber 120 to remove the etchant residue 70 and remnant

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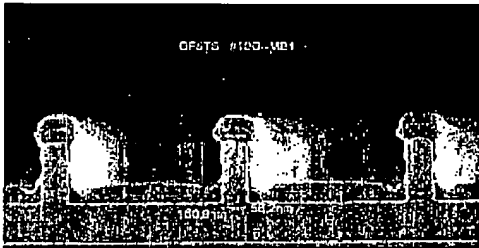
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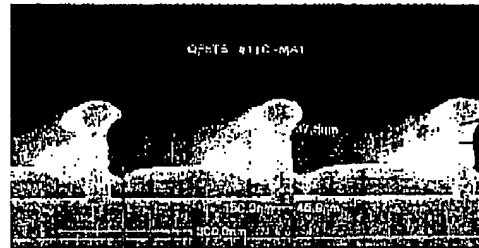
resist 60 (col. 6, lines 19-54). In other words, the cleaning step disclosed by Chen is performed after the anti-reflective material 50, the electrically conductive material 45 and the diffusion barrier layer 40 are etched. *The cleaning step is used to remove the etchant residue and remnant resist remained on the etched features 67 (as shown in Fig. 1B).* Chen does not teach before etching the electrically conductive material 45, a cleaning step is performed to remove the residue on the resist layer. Therefore, the residue remained on the resist layer generated from the etching step of the BARC may be transferred to the electrically conductive material 45 when etching the material layer.

In order to support the arguments as above, applicant provide a photograph to explain the transposition of two process steps in claims 1 and 9 is not identical or equivalent in terms of function, manner and result.

BT 0sec + PR trim 60sec
ADICD 105nm AEICD 55nm



BT 10sec + PR trim 60sec
ADICD 105nm AEICD 46nm



PR
Material layer

Increasing BT time 10sec can narrow Poly AEICD 10nm.

As shown in the paragraph, the left part shows no cleaning step is performed before etching the material layer, whereas the right part shows a cleaning step about 10 seconds is performed before etching the material layer. The material layer at the left part has a width about 55 nm and the material layer at the right part has a narrower width about 46 nm. That is, performing the cleaning step before etching the material layer can form a pattern having a narrower and more accurate width.

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In other words, the patterns of the photoresist layer can be accurately transferred to the material layer in the etching process of the material layer because the polymer remained on the patterned photoresist layer can be removed by the cleaning step before etching the material layer.

For at least the foregoing reasons, Applicant submits the transposition of the process steps of claim 1 of the present invention is not identical or equivalent in terms of function, manner and result to Chen's reference. Independent claim 1 patently defines over the prior art reference, and should be allowed. For at least the same reasons, dependent claims 2, 4-6 patently define over the prior art as well.

The Office Action rejected claims 8-10, 12-14 under 103(a) as being unpatentable over Chen in view of Mui (U.S. 2003/0228532), rejected claims 3 and 11 under 35 U.S.C. 103(a) as being unpatentable over Chen in view of Wolf et al. (Silicon Processing for the VLSI Era, Vol. 1, Lattice Press (1986))(Wolf I) and rejected claims 7 and 15 as being unpatentable over Chen in view of Wolf, (Silicon Processing for the VLSI Era, Vol. 4, Lattice Press (2002))(Wolf IV). Applicant respectfully traverses the rejections for at least the reasons set forth below.

Applicant submits that, as disclosed above, Chen fails to teach or suggest each and every element of claim 1, from which claims 3 and 7-8 depend. Mui, Wolf I and Wolf IV also fail to teach that the cleaning step is performed before the step of etching the material layer. Mui, Wolf I and Wolf IV cannot cure the deficiencies of Chen. Therefore, independent claim 1 is patentable over Chen, Mui, Wolf I and Wolf IV. For at the least the same reasons, its dependent claims 3 and 7-8 are also patentable as a matter of law.

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In addition, as discussed above, Chen fails to teach or suggest that the cleaning step is performed before the step of etching the material layer. Mui also fails to teach that the cleaning step is performed before the step of etching the material layer. Therefore, the references combined do not teach or suggest each and every element in claim 9, and thus independent claim 9 is patentable over Chen and Mui, and should be allowed. In addition, Mui, Wolf I and Wolf IV cannot cure the deficiencies of Chen. Therefore, independent claim 9 is patentable over Chen, Mui, Wolf I and Wolf IV.

In addition, in claim 9, the step of etching the BARC, the cleaning step and the step of etching the material layer are performed *in-situ*. However, Chen teaches the etching step and cleaning step is performed in a multi-chamber apparatus which is not *in-situ*. Mui, Wolf I and Wolf IV also fails to teach the step of etching the BARC, the cleaning step and the step of etching the material layer are performed *in-situ*, and therefore, independent claim 9 is patentable over Chen, Mui, Wolf I and Wolf IV. For at the least the same reasons, its dependent claims 10-15 are also patentable as a matter of law.

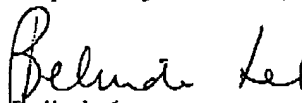
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CONCLUSION

For at least the foregoing reasons, it is believed that the pending claims are in proper condition for allowance. If the Examiner believes that a telephone conference would expedite the examination of the above-identified patent application, the Examiner is invited to call the undersigned.

Date : April 25, 2006

Respectfully submitted,


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